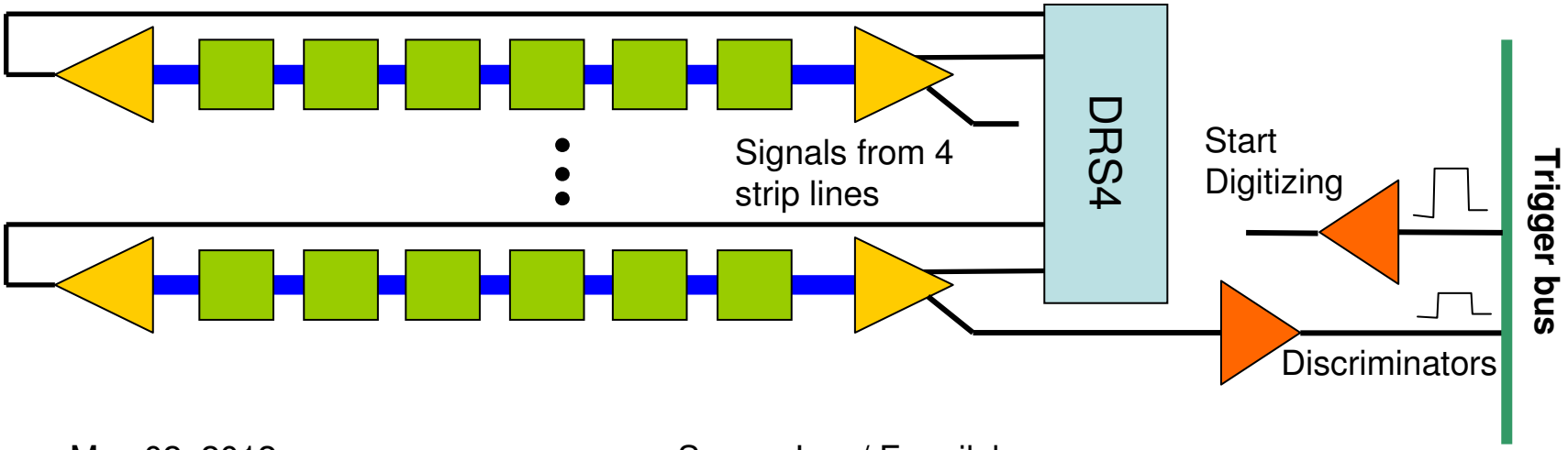
PET-TOF Readout

- **Distributed DAQ configuration is based on local processing, and serial readout, similar to what Sten Hansen was developing, and using for more than a decade**
  - **Strongly recommend to ask him on board as a DAQ hardware designer**

- **Several changes, and new ideas in outline since previous presentation**
  - **Readout transmission line is linear, rather than U-shaped**
    - **Signals shared between SiPMs in two legs of the line will be impossible to attribute**
    - **Signals at both ends of the transmission line are terminated, and amplified**
    - **Amplified signal from the far end is send back to the DRS4 side**
  - **Number of SiPM columns per detector "plank" is a multiple of x4**
    - **DRS4 has 8 channels, 2 channels per strip line**
  - **Distributed analog trigger for any number of the detector "planks"**
    - **Each "plank" generates a trigger (or several) based on signal amplitude**
    - **Trigger signal is applied to a TRIGGER bus line**
    - **DRS4 is stopped, and digitized if there is another trigger on the line at the same time (based amplitude)**



DAQ

- Electronics on a detector plank includes
  - DRS4
  - ADC
  - Buffer memory
  - Data processing logic (FPGA)
  - Serial interface
- For system synchronization we'll use
  - Global clock with a counter on each plank
  - External reset
  - Common Trigger bus line
- Data processing & transmission
  - ADC digitizes as many of the DRS4 cells as required
  - The following can be done in FPGA to reduce data traffic
    - Zero suppression
    - Pedestal correction
    - Charge integration
    - Timing calculations
  - Results with a time stamp are sent to a PC via a serial interface
- Max/Min data flow
  - 100 kHz of trigger rate
  - Event occupies up to 3 strip lines on each side in case of Compton or light cross-talk
    - 24 kB in case no processing is done locally
    - 5 words (plank#, counter, signal time, signal location, charge) in case everything is processed locally
  - Overall data rate can be decreased from 2.4 GBPS to 1 MBPS
- Dead time:
  - DRS4 readout at 33MHz, 48 DRS4 employed (2 being read-out for each trigger). Dead time is 12% for full readout, proportionally smaller for partial readout (which we should work for)
- Required real estate, processing, and power budgets should be estimated
  - Input about TOF algorithms is required